

REMARKS

This is in response to the Official Action currently outstanding with respect to the above-identified application, which Official Action the Examiner has designated as being FINAL.

Claims 1-22 were present in this application as of the time of the issuance of the currently outstanding FINAL Official Action. Claims 1-21 currently stand rejected by the Examiner and Claim 22 stands allowed. Applicants request the entry of the foregoing Amendment of Claim 1 so as to place this application in condition for allowance, or at least in better form for Appeal, pursuant to 37 CFR 1.116. By the foregoing Amendment, Applicants are proposing that Claim 4 be canceled, without prejudice, but are not proposing that any new claims be added or withdrawn. Accordingly, in the event that the Examiner grants the entry of the foregoing Amendment, Claims 1-2 and 5-22 as hereinabove amended will constitute the claims under active prosecution in this application.

The claims of this application are reproduced above including appropriate status identifiers and showing the Amendments sought as required by the Rules.

More specifically, it is noted that in the currently outstanding Official Action, the Examiner has:

1. Acknowledged Applicants' claim for foreign priority under 35 USC §119(a)-(d), and reconfirmed that the required certified copies of the priority document have been received by the United States Patent and Trademark Office.
2. Indicated that Applicants' previous amendment has been entered.
3. Indicated that the drawings filed on 28 April 2006 have been accepted.
4. Rejected Claims 1-21 under 35 USC §103(a) as being unpatentable over Minamio et al. (U.S. Patent No. 6,864,117) in view of Fukasawa et al. (U.S. Patent No. 6,396,082).

5. Indicated that Claim 22 is allowed.

6. Provided Applicants with his Response to their Previous Arguments.

Further comment in these Remarks regarding items 1-3 and 5 above is not considered to be necessary in these Remarks.

Applicant appreciates the Examiner's thorough examination of the subject application and respectfully requests reconsideration of the subject application in view of the foregoing amendments and the following remarks.

In the currently outstanding FINAL Official Action, the Examiner has responded to Applicant's previous arguments as follows:

Applicant argues that the sealing resin of Minamio et al does not equate and is structurally different to the sealing body of the present invention. **However, the argument does not reflect the claim language.** *Although the Minamio et al reference's sealing resin does have different structural characteristics, the claim language only requires the sealing body to be formed in a region excluding the optical path and seals the optical element mounted on the mounting body.* As explained in the rejection above, Minamio et al meets the requirements of the claim language. (Emphasis Added)

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Applicant also argues the thermal conductivity of the Minamio et al reference can not perform the same function as the present invention. **Again, this argument does not reflect the claim language.** *The claim language only requires for the sealing body to have thermal conductivity.* Furthermore, every component inherently has a thermal conductivity, even if the thermal conductivity of the component is zero. Therefore, the Minamio et al reference meets the terms of the claim limitations. (Emphasis Added)

The foregoing statements of the Examiner appear to Applicant to indicate an avenue toward allowance of the above-identified application. In particular, as far as Applicant can tell, the Examiner has admitted that there are differences between the present invention and the Mimamio et al reference in that (1) the sealing bodies of the reference(s) and the present invention are different, and in that (2) the thermal conductivity features of the respective sealing bodies also are different. However, it is Applicant's understanding that the Examiner does not believe that these distinctions have been brought out sufficiently in the claims of this application.

Applicant respectfully submits that the foregoing Amendment to Claim 1 overcomes the basis of the Examiner's outstanding rejections and places Claims 1-2 and 5-21 in condition for allowance. (Claim 22 already stands allowed.)

Specifically, by the foregoing Amendment, Applicant has proposed that Claim 1 be amended so as to indicate:

- i) a portion of the optical element blocks the light transmitting section at one end portion of an axis direction thereof – (to establish antecedent basis for Applicant's later amendment);
- ii) a sealing body having thermal conductivity that is formed in a region excluding the optical path, ~~and seals said sealing body being sealingly affixed to said mounting body in closely surrounding relation to said optical element and so as to cover said the optical element mounted on the mounting body thereby blocking in thermally conductive relation all sides thereof other than the portion of said optical element blocking the light transmitting section,~~ wherein the sealing body is made of a molding resin, and is formed by molding – (This amendment is supported by the drawings, particularly Figs 4A – 4C and the related description thereof (see page 44 et seq. of present specification) – see also for example, page 9, first full paragraph)

- iii) wherein a linear expansion coefficient of the sealing body is set equal to, or almost equal to, a linear expansion coefficient of wire or other optical element. – (to further clarify the thermal relationships being claimed)

Hence, Applicant respectfully submits that its previous argument (reproduced below for convenience of reference) in view of the foregoing Amendment which addresses the Examiner's concerns arising his apparent belief that Applicant was at the time of the next previous Amendment in this application attempting to read limitations for the specification improperly into the claims has now placed this application in condition for allowance.

Therefore, it will be recalled that Applicant previously argued in these regards that:

The Examiner apparently has equated the sealing body 29 of the present invention with the sealing resin 6 of the Minamio reference. Applicant respectfully submits, however, that the Examiner's position in this regard cannot be supported on the present record.

The Minamio reference describes that: "The periphery of the imaging element 4 is filled with a sealing resin 6 so as to hermetically seal a gap between the end portion of the imaging element 4 and the base 31." (see Minamio at Column 1, lines 33-37) As reference to Figure 1 (*and Figs. 4A – 4C as mentioned above*) of the present application in comparison to the Minamio reference readily shows, however, the sealing resin 6 of the Minamio reference is distinctly and completely constitutionally different in structure from "a sealing body that is formed in a region excluding the optical path, and seals the optical element mounted on the mounting body" as in the present invention (*as further amended hereinabove*).

Still further, from the point of view of thermal conductivity, according to the constitution of the Minamio reference, it is readily apparent that heat from the imaging element 4 escapes only to the base 31 via a protrusion electrode 7. In the present invention, on the other hand, it is clear that “by setting large the heat transmission rate of the sealing body 29, the heat dissipation characteristics of the to-be-mounted bodies 22, 32, 33a and 33b can be increased” such that the sealing body 29 can function as a heat sink (see present specification, Page 29, lines 12-15)

Consequently, heat from the optical element 22 can escape not only to the mounting body 34, but also to the sealing body 29 whereby the overall thermal conductivity achievable with the present invention is unequivocally superior to that of the Minamio reference (even though Applicants’ previous utilization of the term “high thermal conductivity” has been read by the Examiner more broadly than the context of Applicants’ previous argument suggested was contemplated by the use of that terminology in the next previous Amendment). Hence, Applicants respectfully submit that their previous arguments with respect to “high thermal conductivity” at the very least support Applicants’ present position that the overall heat conductivity of the present invention is superior to that of the Minamio reference. Those arguments are quoted below for the convenience of the Examiner.

“More specifically, support for the amendments proposed above is found in the present specification as follows:

The optical element 22 blocks one end portion 48 of the light transmitting section 38 in its axis direction, and is attached to a surface portion 39 of the optical element mounting section 34 on the side in one thickness direction A1. Herein, the one end portion 48 of the light transmitting section 38 in the axis direction serves as a side end portion of the light transmitting section 38 on the side in one thickness direction A1.

The optical element 22 is provided with an optical surface 41. When the optical element 22 is a light-emitting element, e.g., LED, the optical surface 41 serves as a light-emitting surface. When the optical element 22 is a light-receiving element, e.g., PD, the optical surface 41 serves as a light-receiving surface. The optical surface 41 is directed to the light transmitting section 38 from the side in one thickness direction A1, and is disposed on the extension line of the optical path 80. As such, the optical element 22 is so disposed that the optical surface 41 faces the optical element mounting section 34 of the lead frame 30. Such placement of the optical element 22 and the lead frame 30 is sometimes referred to as face-down placement. (Page 27, line 7 to Page 28, line 4 and Fig. 1).

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This enables to easily transfer the heat generated on the optical surface 41 to the optical element mounting section 34, and the heat dissipation characteristics of the optical element 22 can be made better. As a result, the operating temperature of the optical element 22 can be reduced so that the optical element 22 can be stably operated even under the high temperature environment. Moreover, the stress to be produced in the optical element 22 can be reduced while suppressing the heat expansion of the optical element 22 so that the optical element 22 can be protected from any possible damage. When an LED is used for the optical element 22, the optical surface 41 serving as an active surface layer of the LED produces heat. The optical element 22 is thus large in heat resistance. Therefore, with the conventional face-up placement, i.e., with the placement in which the surface opposite the optical surface 41 is attached to the lead frame 30, the heat transmission rate is low from the optical surface 41 to the optical element mounting section 34, and the heat dissipation characteristics are thus poor.

On the other hand, in the invention, with the face-down placement in which the optical element 22 is attached to the lead frame 30, the heat is transferred from the optical surface 42 directly to the lead frame 30 without going through the optical element 22. With such a configuration, the heat dissipation characteristics of the optical element 22 can be made better. Especially when the optical element 22 is made of gallium arsenide (GaAs), the heat resistance is high so that the heat dissipation characteristics of the optical element can be improved to a further degree. With the face-down placement, a surface portion 46 of the optical element 22 is in contact with the lead frame 30 on a side in the other thickness direction A2. This thus eliminates the need to use the sealing body 29 for sealing the neighboring portion of the optical surface 41. With such a configuration, even if the optical element 22 is small in size, there is no more need to dispose the sealing body 29 in the neighboring portion of the optical surface 41 so that the sealing structure 20 can be manufactured with ease.

When the optical element 22 and the optical element mounting section 34 are electrically connected to each other, for attachment of the optical element 22 and the optical element mounting section 34, it is preferable to use an adhesive material with electrical conductivity for attachment of the optical element 22 to the optical element mounting section 34. This achieves to attach the optical element 22 to the optical element mounting section 34 in one operation while establishing an electrical connection therebetween.

What is more, among any highly-conductive adhesives, using a material of a high thermal conductivity or a thin film material will lead to sufficient heat contact. It is more preferable if the adhesive can absorb any difference between the linear expansion coefficient of the lead frame 30 and that of the optical element. For example, such an adhesive material can be implemented by silver paste or solder paste. Alternatively, eutectic gold bonding will do for attachment of the optical element 22 to the optical element mounting section 34.

(Page 35, line 2 to Page 37, line 13).

Accordingly, Applicants respectfully submit that it is self-evident that, because the mounting body is made of metal or Si with high thermal conductivity, rather than being made of resin with low thermal conductivity, the heat dissipation characteristics can be made better.”

In addition, as described in the present specification at page 28, line 20, to page 29, line 12, the present invention by virtue of the foregoing amendment now contemplates for all of its embodiments a combination of elements having capabilities not envisioned by Minamio either alone, or in combination with the Fukasawa reference. Specifically, the above-mentioned passage of the present specification that conclusively establishes the foregoing distinction reads as follows:

By making the linear expansion coefficient of the sealing body 29 closer in value to the linear expansion coefficients of the to-be-mounted bodies, i.e., the optical element 22, the wires 33a and 33b, and the driver circuit 32, the to-be-mounted bodies 22, 32, 33a and 33b can be increased in shock resistance. Note here that when the to-be-mounted bodies 22, 32, 33a and 33b each have a different linear expansion coefficient, the expansion coefficient of the sealing body 29 is optimally set so as to minimize any possible damage to the to-be-mounted bodies 22, 32, 33a and 33b.

For example, the linear expansion coefficient of the sealing body 29 is set to be almost the same as the linear expansion coefficient of the wires 33a and 33b or the optical element 22. The expression of almost the same includes the case where the values are exactly the same. This enables to reduce any possible damage of the to-be-mounted bodies 22, 32, 33a and 33b. Moreover, by setting large the heat transmission rate of the sealing body 29, the heat dissipation characteristics of the to-be-mounted bodies 22, 32, 33a and 33b can be increased.

Applicants, therefore, again respectfully submit that neither the Minamio nor the Fukasawa reference whether taken alone or in combination with one another teach, disclose or suggest all of the features of the present invention now specifically set forth in Claim 1 (and by inference, the claims dependent therefrom). Consequently, Applicants respectfully submit that the Minamio and Fukasawa references whether taken alone or in combination with one another are insufficient to teach, disclose or suggest to one of ordinary skill in the art the improvements in the heat dissipation characteristics achieved by the present invention.

Accordingly, Applicants respectfully submit that the present invention should be recognized to have novelty and to be nonobvious over the references currently at issue. Entry of the foregoing Amendment, reconsideration and allowance of this application as hereinabove amended, therefore, are respectfully requested in response to this communication.

Applicants believe that additional fees are not required in connection with the consideration of this response to the currently outstanding Official Action. However, if for any reason a fee is required, a fee paid is inadequate or credit is owed for any excess fee paid, you are hereby authorized and requested to charge and/or credit Deposit Account No. **04-1105**, as necessary, for the correct payment of all fees which may be due in connection with the filing and consideration of this communication.

Respectfully submitted,

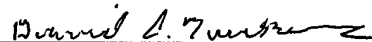
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